6 FEBRUARY 1979 (FOUO 8/79) 1 OF 1

FOR OFFICIAL USE ONLY

JPRS L/8267

6 February 1979

USSR

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY
PHYSICAL SCIENCES AND TECHNOLOGY
(FOUO 8/79)

U. S. JOINT PUBLICATIONS RESEARCH SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000100020012-5

BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS L/ 8267	2.	3. Recipient's Accession No.
4. Title and Subtitle TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY - PHYSICAL SCIENCES AND TECHNOLOGY , (FOUO 8/79)			5. Report Date 6 February 1979
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No.
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered
			14.
15. Supplementary Notes			

16. Abstracts

The report contains information on aeronautics; astronomy and astrophysics; atmospheric sciences; chemistry; earth sciences and oceanography; electronics and electrical engineering; energy conversion; materials; mathematical sciences; cybernetics, computers; mechanical, industrial, civil, and marine engineering; methods and equipment; missile technology; navigation, communications, detection, and countermeasures, nuclear science and technology; ordnance; physics; propulsion and fuels; space technology; and scientists and scientific organization in the physical sciences.

17. Key Words and Document Analysis. 17a. Descriptors

USSR	Electronics	Missile Technology
Aeronautics	Electrical Engineering	Navigation and Communications
Astronomy	Energy Conversion	Detection and Countermeasures
Astrophysics	Materials	Nuclear Science and Technology
Atmospheric Sciences	Mathematics	Ordnance
Chemistry	Mechanical Engineering	Physics
Computers	Civil Engineering	Propulsion and Fuels
Cybernetics	Industrial Engineering	Space Technology
Earth Sciences	Marine Engineering	
Oceanography	Methods	
	Equipment	

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 01,03,04,07,08,09,10,11,12,13,14,16,17,18,19,20,21,22

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
For Official Use Only. Limited Number of Copies Available From JPRS	UNCLASSIFIED	53
	20. Security Class (This Page) UNCLASSIFIED	22. Price

FORM NTIS-35 (REV. 3-72) THIS FORM MAY BE REPRODUCED USCOMM-DC 14952-P72

JPRS L/8267

6 February 1979

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY
PHYSICAL SCIENCES AND TECHNOLOGY

(FOUO 8/79)

CONTENTS PAGE

CONTENTS (Continued) Page

ELECTRONICS AND ELECTRICAL ENGINEERING

UDC 621.37/.39:534

SURFACE ACOUSTIC SHEAR WAVES IN PERIODIC STRUCTURES ON THE SURFACE OF SOLIDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 9, 1978 pp 1939-1947 manuscript received 29 Mar 78

[Article by Yu.V. Gulyayev and V.P. Plesskiy]

[Text] A study is made of the influence of periodic inhomogeneity of the surface of an elastic solid on the properties of surface and body acoustic waves propagated near this surface. It is demonstrated that a slow-speed purely shear-type surface wave can be propagated along the corrugated surface of an elastic body. A study is made of electronic damping and amplification of these waves. A study is made of amplification of a normally incident acoustic shear wave when reflected from the periodically uneven interface between a piezoelectric crystal and a semiconductor in which electron drift has been created. A theoretical prognostication is made of resonance transmission of an acoustic wave through a vacuum slit in a piezoelectric crystal. This effect takes place in normal incidence of a wave onto a slit with periodically uneven edges and is explained by the resonance generation of slit waves in the system.

Introduction

As we know, periodic structures have been quite extensively and successfully employed in electrodynamics (cf., e.g., [1, 2]). As an example can be cited moderating structures along which an electromagnetic wave can be propagated with a velocity considerably lower than the speed of light. This wave can interact effectively with an electron stream moving in the direction of propagation of the wave at a velocity close to the phase velocity of the wave. This type of interaction is utilized in a traveling wave tube and other devices.

In recent years much attention has been paid to studying the feasibility of employing acoustic (sound) waves in electronics. This trend has been called "acoustoelectronics." It is possible to believe that the application of periodic structures in acoustoelectronics, just as in superhigh frequency electrodynamucs, will open up new possibilities and will result in the creation of new acoustoelectronic devices and apparatus.

Of interest in particular is the feasibility of substantial moderation of acoustic waves. In spite of the fact that acoustic waves are so "slow" in comparison with electromagnetic (on this is based one of the most important applications of acoustic waves in radioelectronics--in delay lines), nevertheless it often proves to be desirable that their speeds were even lower. This situation arises, for example, in creating delay lines for a very long delay period (hundreds of microseconds and longer), in developing acoustoelectronic amplifiers, when for the purpose of realizing the sound amplification effect it is necessary that the velocity of the electron drift exceed the phase velocity of the wave, in developing acoustoelectronic devices for frequencies below 1 MHz, when a substantial reduction in wave length is required at a specific frequency, etc.

Recently in [3] and [4] the idea was independently advanced of the possibility of substantial moderation of acoustic waves by means of periodic structures created on the surface of an elastic solid.

This article is devoted to a theoretical discussion of the moderation effect, as well as of questions related to the dissipation of moderated surface acoustic waves at irregularities in the periodic structure and to their electronic absorption and amplification. Also constructed is a theory of certain diffraction phenomena in piezoelectric crystals with a periodically uneven surface. Consideration is given, that is, to the possibility of electronic absorption and amplification of acoustic waves when they are reflected from a periodically uneven interface between a piezoelectric crystal and semiconductor and of the transmission (including complete) of an acoustic wave through a periodically uneven slit between piezoelectric crystals.

1. Slow Surface Acoustic Shear Waves in Periodic Structures on the Surface of Solids

In [3, 4] it was demonstrated simultaneously and independently that along the surface of a solid covered with fins of rectangular shape or having periodically spaced slits of a specific depth along the line perpendicular to these fins propagation of a slow-speed purely shear-type surface acoustic wave (PAV) is possible, with mechanical movement along the fins. It was demonstrated that with specific ratios between the dimensions of the fins and the wavelength the phase velocity of these waves can be very low--substantially lower than the velocity of a transverse acoustic body wave. In [4] was indicated the definite analogy between these waves and Love waves. Love waves are purely shear-type PAV's, propagated along the surface of a solid covered with a thin (of the order of magnitude of or less than the wavelength) film of another material with a lower acoustic shear wave velocity. Actually, the creation of a system of fins on the surface of an elastic solid reduces the rigidity of the surface layer, i.e., as though it lowers the effective shear modulus of the material in the surface region.

Generally, when the base and system of fins are made of different materials, constant κ , which specifies the exponential attenuation of displacement into the interior of the material of the base, is given by the equation:

$$\varkappa = \frac{C_2}{C_1}\frac{d}{l}k_2\,\mathrm{tg}\,k_2h. \tag{1}$$

Here C_1 and C_2 are the shear moduli of the material of the base and the material of the fins; d and h are the thickness and height of the fins; ℓ is the spacing of the structure; $k_2 = \omega/v_{t2}$ is the wave number of the shear wave in the material of the fins (ω is the wave frequency and v_{t2} is the velocity of the shear wave in the material of the fins).

Here the velocity of a slow-speed surface wave is given by the expression:

$$v_s = \frac{v_{t1}}{\sqrt{1+\left(\frac{v_{t1}C_2d}{v_{t2}C_1l}\right)^2 \mathrm{tg}^2\,k_2h}}, \tag{2}$$

where v_{t1} is the velocity of the shear wave in the base. Equations (1) and (2) can be arrived at easily by using the complete surface compatibility in [4] between equations for H-polarized electromagnetic waves propagated in a two-dimensional moderating structure (cf. [1]) and equations for purely shear-type acoustic waves (with the line of shear along the fins or slits) propagated along a corresponding two-dimensional structure on the surface of a solid, as well as the identical type of individual boundary conditions.

The expressions written here are valid in a single-wave approximation [1], when the length of the moderated wave is considerably greater than the structure's spacing. As is obvious from (2), with an increase in the frequency of the wave, as the condition $k_2h = \pi/2$ is approached the surface shear wave considered here will experience as heavy moderation as desired. However, since when $k_2h \sim \pi/2$ equation (2) is no longer valid (the length of a slow PAV must be greater than the spacing of the structure), the maximum possible moderation is of the order of h/ℓ. As a numerical example let us consider a periodic structure on the surface of fused quartz ($v_{t1} = v_{t2} = 3.5\cdot10^5$ cm/s) with dimensions of $\ell = 4\ \mu$, $d = 2\ \mu$, $h = 85\ \mu$. For a purely shear-type PAV with a frequency of 10 MHz from (2) we get $v_s \simeq 0.1\ v_t$, i.e., the wave is slowed approximately 10-fold as compared with a body acoustic shear wave. Here the length of a slow PAV equals 35 μ, and the depth of penetration into the material of the base equals $d = \varkappa^{-1} \simeq 6\ \mu$, i.e., the wave is of a clearly pronounced surface nature.

2. Attenuation of Slow Waves on Account of Dissipation in Imperfections in the Periodic Structure and Amplification of These Waves by a Drift-Type Electron Stream

The periodic structures described can be obtained by the ionic etching method, or, possibly, by special growing. But with any method of fabrication the structures will have occasional deviations from strict periodicity, which will result in attenuation of the slow wave as a result of its dissipation. Estimates have shown that the greatest dissipation takes place in the case of variations in the height of the fins. In this case the coefficient of wave attenuation can be estimated from the equation in [5]:

$$\Gamma \simeq q(ql)^3 \frac{\langle(\delta h)^2\rangle}{l^2} \sin kh. \tag{3}$$

Here q is the wave number of a slow PAV, and $\langle(\delta h)^2\rangle$ is the mean square of the deviation in the height of the fins from the mean value. For simplicity in (3) it was assumed that the slits are infinitely thin and the fins are made of the same material as the base ($k_1 = k_2 = k$).

A slow shear PAV can undergo electronic absorption (or amplification) as the result of interaction with free drifting electrons in semiconductors. For the sake of definiteness, let us consider a piezoelectric semiconductor whose surface is covered with rectangular fins made of a nonpiezoelectric dielectric. The orientation of the piezoelectric semiconductor is such that a shear PAV with mechanical movement along the fins is piezoactive (e.g., in the case of CdS the hexagonal axis can be directed along the fins). In the case of fairly low-frequency ultrasound, when $qr_D \ll 1$ (r_D is the Debye radius), for the coefficient of electronic absorption (amplification) of the wave under conditions of considerable slowing we get the following expression [5]:

$$\alpha = \eta q \frac{\omega'\tau_M}{1+\left(1+\frac{\varepsilon_2}{\varepsilon_1}\right)^2(\omega'\tau_M)^2}, \tag{4}$$

where $\eta = K^2$ is the electromechanical coupling constant; τ_M is the Maxwellian relaxation time; ε_1 and ε_2 are the dielectric constants of the piezoelectric semiconductor and the material of the fins, respectively; and $\omega' = \omega - Qv_d$ ($Q = 2\pi/\ell$ and v_d is the velocity of electron drift in the direction of the wave).

The estimate of the attenuation coefficient in (4) is similar to estimates made previously in [6, 7] of the amplification factors of Love and Rayleigh waves in laminar structures. It is easy to see that when $v_d > v_s$ the coefficient of electronic absorption, α, is less than zero, i.e., absorption of this wave changes into amplification when the velocity of electron drift in the direction of the wave exceeds its phase velocity.

For numerical estimates let us consider a CdS crystal whose surface is covered with fins made of a dielectric close in mechanical parameters to CdS ($v_t \simeq 2 \cdot 10^5$ cm/s). Let the dimensions of the fins be the following: $h = 47\ \mu$, $d = 3\ \mu$, and $\ell = 6\ \mu$; and the hexagonal axis, C_6, is parallel to the direction of the fins. The concentration and mobility of electrons equal, respectively, $n = 1.5 \cdot 10^{12}\ \mathrm{cm}^{-3}$ and $\mu = 200\ \mathrm{cm}^2(\mathrm{V \cdot s})^{-1}$. Then, with a frequency of 10 MHz, for the velocity and amplification factor (when $(v_d/v_s) - 1 = 1$) of a slow PAV we get $v_s = 3.7 \cdot 10^4$ cm/s $\simeq v_t/5$ and $\alpha = 65$ dB/cm. The Joule heat released in the process is approximately 4 W/cm^3, which can be diverted under continuous conditions.

Let us note also that in view of the reduction in wavelength during slowing (increase in q) the maximum value of the electronic amplification factor per unit of length of the crystal is greater than for a body shear wave of the same frequency.

3. Effect of Amplification of an Acoustic Wave in Reflection from a Periodically Uneven Interface Between a Piezoelectric Crystal and a Semiconductor

As we know, in an "Orotron" or diffraction generator [8, 9] the electron beam interacts not with the fundamental electromagnetic wave present in the open resonator, but with one of the harmonics of the field originating near the reflector, which is made in the form of a periodic structure. The spacing of the structure is selected as considerably smaller than the wavelength of the resonant frequency, so that the phase velocity of field harmonics originating near the periodic structure is found to be many times less than the speed of light, which facilitates obtaining the required electron beams.

Below we will construct the theory of an "acoustic 'Orotron,'" i.e., we will describe the amplification of a wave when reflected from the periodically perturbed surface of a piezodielectric near which there is a semiconductor with a drift-type electron stream.

Let us mention that the amplification of an acoustic wave upon reflection from the smooth interface between a piezodielectric and semiconductor was discussed previously in a number of studies [10, 11].

It was demonstrated that fairly strong interaction between the wave and the semiconductor's electrons takes place only with very oblique (almost glancing) incidence of the wave at the interface. In the case of a periodically uneven interface which we discuss, strong interaction is gotten even with normal incidence of the wave at the interface.

For the sake of definiteness, let us discuss a piezodielectric of class C_{6v}, with a hexagonal axis along axis OZ (cf. fig 1), occupying the region of $y > \zeta(x)$. Then $y = 0$ equals the mean value of periodic function $y = \zeta(x)$, describing the boundary of the piezodielectric. The lower space is occupied by the semiconductor, in which is created an electron drift in the direction of axis OX. We will assume that there is no mechanical contact between the piezodielectric and the semiconductor. A normally incident purely shear-type acoustic wave is propagated in the direction opposite axis OY and has mechanical displacement in terms of axis OZ. We will assume that the spacing of the inhomogeneity is less than the wavelength, and its height is small as compared with the period; we assume the angles of inclination of irregularities of the surface to be small. Reflection from such a surface takes place as from a smooth one along the normal to it, since in view of the small irregularity spacing of the boundary only one interference maximum is possible for the secondary waves generated by inhomogeneity of the boundary--in the direction of axis OY.

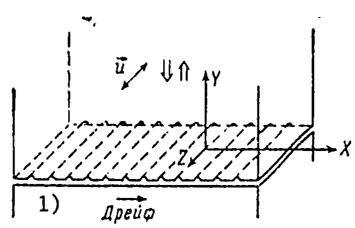

Figure 1. Geometry of System

Key:

1. Drift

Near the uneven boundary there arise periodic distortions of mechanical and electric fields. The period of these distortions along axis OX equals the spacing of the surface's unevenness. Here an electric field originates also outside the piezoelectric crystal and is in the form of a standing wave with a period equal to the spacing of the surface's unevenness, ℓ , and a frequency equal to the frequency of the incident acoustic wave. The electric field emerging near the uneven boundary of the piezoelectric crystal represents the superposition of two waves of electric potential traveling at a velocity of $(\lambda_t/\ell)v_t < v_t$ (λ_t is the length of the acoustic wave). The interaction of these fields with charge carriers in the semiconductor also results in attenuation (amplification) of the reflected wave.

Assuming that $y = \zeta(x) = \zeta_0 \cos Qx$, where $Q = (2\pi/\ell) > k$ is the wave number of the unevenness (k is the wave number of the incident wave), as the result of calculation we find the wave's reflection coefficient [12]:

$$|R| = 1 + \frac{\eta}{2}\cdot\frac{kQ}{Q^2-k^2}(k\zeta_0)^2 \operatorname{Im} G. \tag{5}$$

Here

$$G = \frac{\varepsilon_{э\phi}(\omega')}{\varepsilon_1 + \varepsilon_{э\phi}(\omega')} + \frac{\varepsilon_{э\phi}(\omega'')}{\varepsilon_1 + \varepsilon_{э\phi}(\omega'')}, \qquad (6)$$

where ε_1 is the dielectric constant of the piezodielectric, and $\varepsilon_{ef}(\omega, Q)$ is the "effective dielectric constant" of the semiconductor; $\omega' = \omega - Qv_d$; $\omega'' = \omega + Qv_d$ (v_d is the velocity of electron drift along axis OX).

The value of Im G , with the degree of accuracy of a constant factor, determines the total amplification factor of a PAV when passing through a specific section in the direction of electron drift and counter to electron drift. Such bidirectional amplification usually takes place with a drift velocity somewhat greater than the velocity of the PAV. But entering (6), instead of the velocity of the PAV, is $v_p = \omega/Q < v_t$ --the velocity of the harmonic of the electric field. Thus, amplification during reflection will be accomplished at the velocity of electron drift, which is approximately Q/k times less than is required for a normal PAV amplifier.

It is obvious from (5) that the amplification of the acoustic wave during reflection achieved in this case is not so great, since it is proportionate to the product of minor parameters, $(k/Q)(k\zeta_0)^2$. But if it nevertheless is greater than the losses incurred in propagation of the acoustic wave in the body of the piezodielectric and in reflection from the opposite boundary, then through multiple reflection the amplification will be built up and generation is possible in the system.

If instead of slight unevenness of the surface use is made of a heavily uneven surface of the comb type, as is done in an "Orotron," then it is possible to increase the amplification factor of the wave in reflection. Of course, the amplification factor remains small in terms of parameter η , but parameter $(k\zeta_0)^2$, resulting from the slight degree of unevenness, disappears.

This phenomenon is modified substantially if the length of the incident wave becomes comparable with the spacing of the structure [13]. Let the frequency of the incident wave be such that the length of a purely shear-type surface electroacoustic wave [14, 15] of this frequency agrees with the spacing of the structure, ℓ . Each unevenness generates a surface wave with an amplitude proportionate to the amount of unevenness and the electromechanical coupling constant [16] ($\sim\eta\gamma$, where $\gamma \sim Q\zeta_0 \ll 1$ is a minor parameter describing the unevenness of the surface). This wave, being propagated along the uneven surface, attenuates on account of backscattering into the body at a distance on the order of $(\eta\gamma^2)^{-1}$ wavelengths [17]. When the length of the surface wave is close to the spacing of the structure, waves generated by different sections of the inhomogeneous surface are combined in phase. Therefore the amplitude of the mechanical displacement at a certain point will be determined by the sum of the amplitudes of waves having developed from a distance of $\sim(\eta\gamma^2)^{-1}$, i.e., will be on the order of $\eta\gamma(\eta\gamma^2)^{-1} = \gamma^{-1} \gg 1$. Thus, the amplitude of resonantly excited purely shear-type surface electroacoustic waves can be substantially greater than the amplitude of the incident wave (which is assumed to equal one). Moreover, if $\eta > \gamma^2$, then the "electric" portion of the density of the energy of excited surface waves will be comparable to or greater than the density of the entire energy in the incident acoustic wave. This means that interaction of surface waves with drifting electrons in the adjacent semiconductor can result in considerable (without minor parameter η) alteration of the amplitude of the reflected wave.

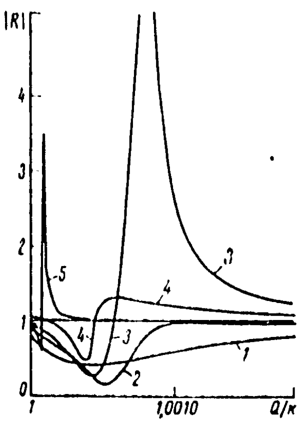

Figure 2. Dependence of Modulus of Reflection Coefficient on Frequency of the Incident Wave, 1-4: $\eta = \gamma 2 = 0.04$; 1--$y = v_d/v_s = 0$; 2--$y = 1.0$; 3--$y = 1.2$; 4--$y = 2.0$; 5--$\eta = 0.01$, $\gamma^2 = 0.04$, $y = 1.2$

The estimate in [17] confirms these qualitative notions. For the reflection coefficient the following expression is generally obtained:

$$R = \frac{1 + i\left(\frac{\gamma}{2}\right)^2 \left\{ \frac{k}{\varkappa_1 - \delta^{(+)}Q - \left(\frac{\gamma}{2}\right)^2 \frac{k}{\varkappa_2}} + \frac{k}{\varkappa_1 - \delta^{(-)}Q - \left(\frac{\gamma}{2}\right)^2 \frac{k}{\varkappa_2}} \right\}}{1 - i\left(\frac{\gamma}{2}\right)^2 \left\{ \frac{k}{\varkappa_1 - \delta^{(+)}Q - \left(\frac{\gamma}{2}\right)^2 \frac{k}{\varkappa_2}} + \frac{k}{\varkappa_1 - \delta^{(-)}Q - \left(\frac{\gamma}{2}\right)^2 \frac{k}{\varkappa_2}} \right\}}, \quad (7)$$

where

$$\varkappa_n = \sqrt{(nQ)^2 - k^2}; \quad \delta^{(n)} = \frac{\eta}{1+\eta}\,\frac{\varepsilon_{\text{эф}}^{(n)}}{\varepsilon_1 + \varepsilon_{\text{эф}}^{(n)}}; \quad \varepsilon_{\text{эф}}^{(n)} = \varepsilon_{\text{эф}}(\omega - nQv_d).$$

Curves representing the dependence of $|R|$ on the length of the incident wave and on the drift velocity are shown in figs 2 and 3. The effective dielectric constant of the semiconductor was taken in the following form:

$$\varepsilon_{\text{эф}}(\omega, Q) = \varepsilon_{\text{п}}\left(1 - \frac{1}{i\omega\tau_{\text{м}}}\right). \tag{8}$$

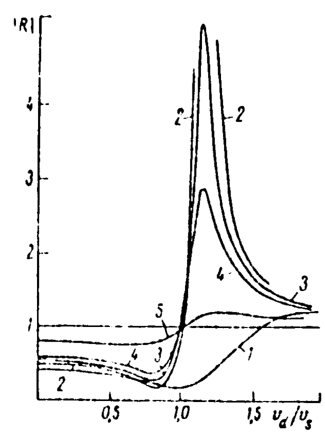

Figure 3. Dependence of Modulus of Reflection Coefficient on Velocity of Electron Drift: $\eta = \gamma^2 = 0.04$; 1--$x = Q/k = 1.0005$; 2--$x = 1.0008$; 3--$x = 1.0009$; 4--$x = 1.0010$; 5--$x = 1.0020$

Here it was assumed that the dielectric constants of the piezodielectric, ε_1, and the semiconductor, ε_p, are identical: $\varepsilon_p = \varepsilon_1$; it was also assumed that $\omega_0 \tau_m = 1$, where $\omega_0 = v_t Q$ is the frequency at which the length of the body shear wave is equal to the spacing of the structure.

The question of the possibility of generation of waves in this structure requires further study.

Finally, let us give numerical estimates of the dimensions of the structure. So, with a frequency of $f = 500$ MHz, $\eta = \gamma^2 = 0.04$, and $v_t = 3 \cdot 10^5$ cm/s, the lattice spacing should be $\ell = 6\ \mu$, and its length must considerably exceed $L_0 = 1.5$ cm.

4. Resonant Transmission of an Acoustic Wave Through a Slit Between Piezoelectric Crystals

Let a piezoelectric crystal with a periodically perturbed boundary occupy the region of $y < 0$. As before, let us assume that the piezoelectric crystal belongs to class C_{6v} and its hexagonal axis is in line with OZ. If in the region of $y > 0$ is placed the same piezoelectric crystal with identical perturbations of its surface, then the surface electroacoustic shear waves originating on account of unevenness of the lower surface (from which a body wave is reflected) will generate surface waves on the upper surface, which, being scattered in turn at unevennesses, will produce a body wave moving along the normal to plane $y = 0$. Ultimately the incident body acoustic wave, at least in part, will pass through the slit in the piezoelectric crystal. When $\eta > \gamma^2$, as demonstrated by the estimate in [1^], this passage can be total. The absolute value of the transmission coefficient is given by the equation:

$$|T| = \frac{\frac{1}{2}\eta\gamma^2}{\sqrt{\left\{\left(\frac{\varkappa_1}{Q} - \frac{\eta}{2} - \frac{\gamma^2}{4\sqrt{3}}\right)^2 - \frac{\eta^2 - \gamma^4}{4}\right\}^2 + \left\{\frac{1}{2}\eta\gamma^2\right\}^2}}. \tag{9}$$

It is possible to demonstrate that the two transmission peaks when $\eta > \gamma^2$ (fig 4) correspond to the excitation of symmetric and antisymmetric slit modes [19]. The width of the transmission curves is on the order of:

$$\frac{\Delta\omega}{\omega} \simeq \frac{\varkappa_1}{k}\gamma^2.$$

A similar transmission effect can take place when the surfaces of the a piezoelectric crystal are covered in addition by elastic layers of thickness $\tilde{h}$. In this case in the system are resonantly excited Love waves, and the two transmission peaks (fig 5) occurring when $a = \eta e^{-2Q\tilde{h}}/\gamma^2 \cos k_2\tilde{h} > 1$ correspond to the excitation of symmetric and antisymmetric modes. The wave transmission coefficient is given by the equation in [20]:

$$T = \frac{1}{2}\left\{\frac{ik_1C_1 - k_2C_2\,\mathrm{tg}\,k_2\tilde{h} - \Delta(-)}{ik_1C_1 + k_2C_2\,\mathrm{tg}\,k_2\tilde{h} + \Delta(-)} - \frac{ik_1C_1 - k_2C_2\,\mathrm{tg}\,k_2\tilde{h} - \Delta(+)}{ik_1C_1 + k_2C_2\,\mathrm{tg}\,k_2\tilde{h} + \Delta(+)}\right\},$$

where

$$\Delta(\pm) = \frac{1}{2}\,\frac{(m_0\omega^2)^2}{C_1\left[q_1(1+\eta) - \frac{1}{2}\eta(1 \pm e^{-2Qh})Q\right] - C_2\varkappa_1\,\mathrm{tg}\,\varkappa_1\tilde{h}}.$$

In these expressions ω is the wave frequency; C_1 and C_2 are the shear moduli of the piezoelectric crystal and material of the layers; k_1 and k_2 are the wave numbers of the body shear wave in the piezoelectric crystal and elastic layer; $q_1 = \sqrt{Q^2 - k_1^2}$; $\kappa_1 = \sqrt{k_2^2 - Q^2}$; and m_0 is the amplitude of the periodic mass load of the surface.

The halfwidth of transmission peaks is on the order of $\Delta\omega/\omega \sim \gamma^2 \cos k_2\tilde{h}$. Estimates have shown that Love waves of great amplitude, $\sim 1/\gamma$, are formed at distances of $\lambda/\gamma^2 \cos k_2\tilde{h}$, i.e., considerably less than the characteristic distance of $\lambda/\eta\gamma^2$ for the formation of purely shear-type surface electroacoustic waves. Therefore, in this case the effect of total transmission of the acoustic wave can be realized with a much smaller aperture of the incident sound beam.

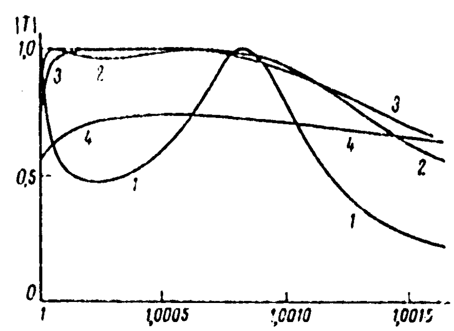

Figure 4. Dependence of $|T|$ on Length of the Incident Wave: $\eta = 0.04$; 1--$\gamma^2 = 0.01$; 2--$\gamma^2 = 0.03$; 3--$\gamma^2 = 0.04$; 4--$\gamma^2 = 0.09$

Conclusion

In recent times periodic structures on the surface of solids have begun to find an application in acoustoelectronics--for the present as structures for reflecting and exciting surface Rayleigh waves (cf., e.g., [20, 21]) and for strip-type directional couplers for these PAV's [22]. These structures, however, practically do not alter the properties of surface acoustic waves as such.

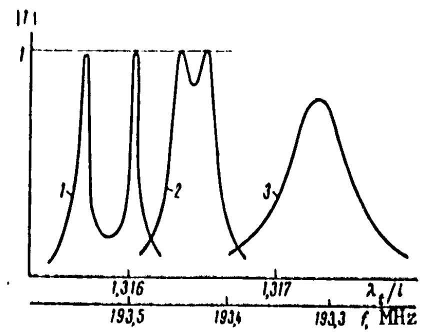

Figure 5. Dependence of $|T|$ on $Q/k_1 = \lambda_t/\ell$. $v_1 = 3 \cdot 10^5$ cm/s--the velocity of the shear wave in the piezoelectric crystal; $v_2 = 2 \cdot 10^5$ cm/s--the velocity of the shear wave in the material of the layer; $h = 3\ \mu$, $\ell = 2\pi/Q = 11.78\ \mu$, $C_1 = C_2$; 1--$\eta = 0.05$, $\gamma = 0.05$, $a \sim 3$; 2--$\eta = 0.03$, $\gamma = 0.1$, $a \sim 0.5$; 3--$\eta = 0.03$, $\gamma = 0.2$, $a \sim 0.1$

In this paper cases have been discussed in which periodic structures substantially modify the properties of acoustic waves: Possible are the origin of slow-speed surface shear waves which do not exist in the absence of a periodic structure, "huge" amplification of waves in reflection from a boundary with a semiconductor, and total transmission through a vacuum slit in a piezoelectric crystal with normal incidence. Experimental detection and study of these effects in our opinion can serve as the basis for the creation of a number of fundamentally new acoustoelectronic devices.

Bibliography

1. Silin, R.A. and Sazonov, V.P. "Zamedlyayushchiye sistemy" [Moderating Systems], Izdatel'stvo Sovetskoye Radio, 1966.

2. Nefedov, Ye.I. and Sivov, A.N. "Elektrodinamika periodicheskikh struktur" [Electrodynamics of Periodic Structures], Izdatel'stvo Nauka, 1977.

3. Auld, B.A., Gagnepain, J.J. and Tan, M. ELECTRONICS LETTERS, 1976, 2, 24, 650.

4. Gulyayev, Yu.V. and Plesskiy, V.P. PISM'MA ZHTF, 1977, 3, 5, 220.

5. Gulyayev, Yu.V. and Plesskiy, V.P. ZHTF, 1978, 48, 3, 447.

6. Gulyayev, V.I. and Pustovoyt, V.I. ZHETF, 1964, 47, 2, 2251.

7. Gulyayev, Yu.V., Karabanov, A.Yu., Kmita, A.M., Medved', A.V. and Tursunov, Sh.S. FIZIKA TVERDOGO TELA, 1970, 12, 9, 2595.

8. Rusin, F.S. and Bogomolov, G.D. PIS'MA ZHETF, 1966, 4, 6, 236.

9. Shestopalov, V.P. "Difraktsionnaya elektronika" [Diffraction Electronics], Vishcha shkola, Izdatel'stvo Khar'kovskogo un-ta, 1976.

10. Lyamshev, L.M. and Shevyakov, N.S. AKUST. ZH., 1973, 19, 918.

11. Balakirev, M.K. and Gilinskiy, I.A. FIZIKA TVERDOGO TELA, 1974, 16, 3144.

12. Gulyayev, Yu.V. and Plesskiy, V.P. PIS'MA ZHTF, 1977, 3, 19, 1028.

13. Gulyayev, Yu.V. and Plesskiy, V.P. RADIOTEKHNIKA I ELEKTRONIKA, 1977, 22, 12, 2604.

14. Gulyayev, Yu.V. PIS'MA SHETF, 1969, 9, 63.

15. Bleustein, J.L. APPL. PHYS. LETTERS, 1968, 13, 412.

16. Gilinskiy, I.A. and Popov, V.V. ZHTF, 1976, 46, 2233.

17. Gulyayev, Yu.V. and Plesskiy, V.P. "Sdvigovyye poverkhnostnyye akusticheskiye volny na periodicheski nerovnoy poverkhnosti tverdogo tela" [Surface Acoustic Shear Waves on a Periodically Uneven Surface of a Solid], Preprint IRE AN SSSR, No 1 (243), 1978.

18. Gulyayev, Yu.V. and Plesskiy, V.P. FIZIKA TVERDOGO TELA, 1978, 20, 133.

19. Gulyayev, Yu.V. and Plesskiy, V.P. AKUST. ZH., 1977, 23, 5, 716.

20. Gulyayev, Yu.V., Nikitov, S.A. and Plesskiy, V.P. FIZIKA TVERDOGO TELA, 1978, 20, 5.

21. Jamanishi, M., Ameda, M., Kawamura, T., Mikoshiba, N. and Tsubouchi, K. ELECTRONICS LETTERS, 1976, 12, 13, 317.

22. Meyns, Peydzh TIIER, 1976, 64, 5, 81.

8831
CSO: 8144/0553

ENGINEERING AND EQUIPMENT

DYNAMIC ERRORS OF A FLOATED INTEGRATING GYRO

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 8, 1978 pp 64-66

[Article by V.A. Koval' and K.P. Andreychenko]

[Text] At the present time floated integrating devices are finding extensive application as gauges of slight angular movement in indicator stabilizers of inertial navigation systems.

Let us investigate the dynamic error of a floated integrating gyro under the influence of forces along the device's axis of sensitivity.

We will assume that the floated unit and the device's body represent two coaxial cylinders which are symmetrically bounded by planes at their ends (cf. fig 1). The spaces between the float and the body are filled with a viscous incompressible fluid.

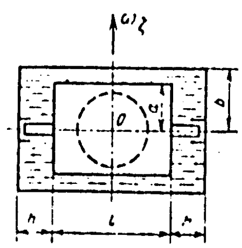

Figure 1.

The equation of motion for the floated unit has the following form:

$$J\frac{d\omega}{dt} = H\omega_\zeta + M_1 + M_2. \quad (1)$$

(1)

where J is the moment of inertia of the floated unit in relation to the axis of the suspension; ω is the angular rotational velocity of the floated unit around this axis; H is the angular momentum of the gyro; ω_r is the component of the angular velocity of an object in relation to the device's axis of sensitivity; M_1 is the force of the effect of the fluid on the cylindrical surface of the float; and M_2 is the force of the effect of the fluid on the end surfaces of the float.

In view of the low Reynolds numbers, we assume that plane-parallel flow of the fluid (Couette flow) takes place in the cylindrical and end spaces, and, according to [1]:

$$M_1 = 2\pi a^2 l \mu \left(\frac{\partial v}{\partial r} - \frac{v}{r} \right) \Big|_{r=a}; \tag{2}$$

$$M_2 = \pi a^4 \mu \left(\frac{\partial \Omega}{\partial z} \right) \Big|_{z=0}, \tag{3}$$

where a is the radius of the float; ℓ is the length of the float; μ is the dynamic viscosity of the fluid; v is the velocity of the fluid in the cylindrical space; r is the instantaneous value of the radius, read from the axis of the suspension; Ω is the angular velocity of the fluid in the end spaces; z is the instantaneous value of the space, read from the surface of the float.

The value of the velocity of the fluid in the lengthwise space between the coaxial cylinders in the floated unit (with the radial and axial components of the fluid's velocity equaling zero) is determined by the equation:

$$\frac{\partial v}{\partial t} = \nu \left(\frac{\partial^2 v}{\partial r^2} + \frac{1}{r} \frac{\partial v}{\partial r} - \frac{v}{r^2} \right) \Big|_{a<r<b,\ t>0}, \tag{4}$$

where b is the radius of the body.

This equation is fulfilled with boundary conditions of $v(a,t) = a\omega(t)$ and $v(b,t) = 0$, and initial conditions of $v(r,0) = 0$ and $a \leq r \leq b$.

The velocity of the fluid in the end spaces is determined by solving the equation in [1]:

$$\frac{\partial \Omega}{\partial t} = \nu \frac{\partial^2 \Omega}{\partial z^2} \Big|_{0<z<h}, \tag{5}$$

where h is the end space.

Equation (5) is valid with boundary conditions of $\Omega(0,t) = \omega(t)$ and $\Omega(h,t) = 0$, and initial conditions of $\Omega(r,0) = 0$.

Let us represent equation (1) by taking (2) and (3) into account, in Carson-Heaviside maps:

$$Js\bar{\omega}(s) = H\omega_0 + 2\pi a^2 l\mu\left[\frac{\partial \bar{v}(r,s)}{\partial r} - \frac{\bar{v}(r,s)}{r}\right]\Bigg|_{r=a} + \pi a^4\mu\left[\frac{\partial \bar{\Omega}(z,s)}{\partial z}\right]\Bigg|_{z=0}. \tag{6}$$

The map of the velocity of the fluid in the cylindrical space is found according to [2] from solving equation (4) by the operation method:

$$\bar{v}(r,s) = a\bar{\omega}(s) \times \frac{I_1\left(b\sqrt{\frac{s}{\nu}}\right)K_1\left(r\sqrt{\frac{s}{\nu}}\right) - I_1\left(r\sqrt{\frac{s}{\nu}}\right)K_1\left(b\sqrt{\frac{s}{\nu}}\right)}{I_1\left(b\sqrt{\frac{s}{\nu}}\right)K_1\left(a\sqrt{\frac{s}{\nu}}\right) - I_1\left(a\sqrt{\frac{s}{\nu}}\right)K_1\left(b\sqrt{\frac{s}{\nu}}\right)}, \tag{7}$$

where I_1 and K_1 are modified first-order Bessel functions of the first and second kind.

Solving equation (5) by the operation method, we find the map for the angular velocity of the fluid in the end spaces:

$$\bar{\Omega}(z,s) = \bar{\omega}(s)\,\frac{\operatorname{sh}(h-z)\sqrt{\frac{s}{\nu}}}{\operatorname{sh} h\sqrt{\frac{s}{\nu}}}. \tag{8}$$

By considering (6), (7) and (8) together, we find the map of the angular rotational velocity of the floated unit:

$$\bar{\omega}(s) = \frac{H\omega_z}{Js + \pi a^3 \mu \left\{ a\sqrt{\frac{s}{\nu}} \operatorname{ctg}\left(h\sqrt{\frac{s}{\nu}}\right) + \frac{2l\sqrt{\frac{s}{\nu}}\left[I_1\left(b\sqrt{\frac{s}{\nu}}\right)K_2\left(a\sqrt{\frac{s}{\nu}}\right) + I_2\left(a\sqrt{\frac{s}{\nu}}\right)K_1\left(b\sqrt{\frac{s}{\nu}}\right)\right]}{I_1\left(b\sqrt{\frac{s}{\nu}}\right)K_1\left(a\sqrt{\frac{s}{\nu}}\right) - I_1\left(a\sqrt{\frac{s}{\nu}}\right)K_1\left(b\sqrt{\frac{s}{\nu}}\right)} \right\}} \tag{9}$$

where I_2 and K_2 are modified second-order Bessel functions of the first and second kind.

Utilizing the Carson-Heaviside theorem regarding the finite value, we find the value of the angular velocity of the float in the steady state:

$$\omega(\infty) = \lim_{t\to\infty} \omega(t) = \lim_{s\to 0} \bar{\omega}(s). \tag{10}$$

We arrive at a solution to (10) by representing the Bessel functions in equation (9) in the form of power series [3]:

$$\omega(\infty) = \frac{H\omega_z}{\pi a^3 \mu \left[\frac{a}{h} + \frac{4b^2 l}{a(b^2 - a^2)}\right]}. \tag{11}$$

The error of the floated integrating gyro under the influence on it of a constant angular velocity relative to its axis of sensitivity has the form:

$$\lim_{t\to\infty} \Delta\beta(t) = \Delta\beta(\infty) = \lim_{s\to 0} \frac{\omega(\infty) - \bar{\omega}(s)}{s}. \tag{12}$$

Computing (12) by taking (9) and (11) into account, we find:

$$\Delta\beta(\infty) = \frac{H\omega_\zeta\left\{J + \pi a^3\rho\left[\frac{ah}{3} + \frac{l(b^2 - a^2)}{2a}\right]\right\}}{\pi^2 a^6 \mu^2\left[\frac{a}{h} + \frac{4b^2 l}{a(b^2 - a^2)}\right]^2}, \tag{13}$$

where ρ is the density of the fluid.

The equation arrived at makes it possible to estimate the influence of the fluid's inertial properties on the systematic error of a floated integrating gyro.

Let us make an estimate of the device's error with the following parameters: $a = 4$ cm, $b = 4.02$ cm, $\ell = 8$ cm, $h = 0.05$ cm, $\mu = 0.4$ Pa·s, $\rho = 2$ g/cm^3, and $J \approx 400$ g-cm^2, under the influence of forces relative to the device's axis of sensitivity.

According to (13), $\Delta\beta(\infty) = 0.96\cdot10^{-6}\ H\omega_\zeta$. The value of this error, estimated according to the method suggested in [4], without taking the fluid's inertia into account, equals $0.77\cdot10^{-6}\ H\omega_\zeta$. The results of this calculation demonstrate that the fluid's inertia exerts a considerable influence on the device's systematic error (the calculated value of the error is 20 percent higher).

The example given and the theoretical propositions made above agree with the results of experimental research in [5].

Bibliography

1. Landau, L.D. and Lifshits, Ye. "Mekhanika sploshnykh sred" [Mechanics of Continuous Media], Moscow, Gostekhizdat, 1944.

2. Tikhonov, A.N. and Samarskiy, A.A. "Uravneniya matematicheskoy fiziki" [Mathematical Physics Equations], Moscow, GITTL, 1951.

3. Gradshteyn, I.S. and Ryzhik, I.M. "Tablitsy integralov, summ, ryadov i proizvedeniy" [Tables of Integrals, Sums, Series and Products], Moscow, Fizmatgiz, 1962.

4. Rivkin, S.S. "Teoriya giroskopicheskikh ustroystv" [Theory of Gyroscopic Apparatus], Part 2, Leningrad, Sudostroyeniye, 1964.

5. Slomyanskiy, G.A. and Pryadilov, Yu.N. "Poplavkovyye giroskopy i ikh primeneniye" [Floated Gyros and Their Application], Moscow, Oborongiz, 1958.

8831
CSO: 8144/0560

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000100020012-5

PUBLICATIONS

THE STRENGTH OF COMPOSITE MATERIALS

Kiev PROCHNOST' KOMPOZITSIONNYKH MATERIALOV (The Strength of Composite Materials) in Russian 1978 signed to press 13 Mar 78 pp 2-4, 233-234

[Annotation, Foreword and Table of Contents from book by Dmitriy Moiseyevich Karpinos, Georgiy Grigor'yevich Maksimovich, Valeriy Khabibovich Kadyrov and Yevgeniy Mikhaylovich Lyutyy, Naukova dumka, 2,000 copies, 236 pages]

[Text] The results of investigations on strengthening metals and alloys by high-modulus and high-strength fibers are generalized in the monograph. The methods of producing composite materials reinforced by discrete and continuous fibers and also by knitted netting are considered. The effect of temperature on the structure and properties of composite materials is studied in detail. Special attention is devoted to interphase interaction of the components of the reinforced systems. The areas of application of fibrous composite materials based on light alloys are considered.

Intended for scientific workers, designers and engineering technicians involved in development and creation of new materials. May be useful to post-graduate students and students of machine-building and metallurgical vuzes.

Foreword

The development of modern technology requires creation of construction materials with high strength and improved characteristics over a wide temperature range. Much attention is now being devoted to development of composite materials -- an essentially new class of heterogeneous structures which consist of metal matrices with uniformly distributed continuous or discrete fibers and filament crystals in them. By combining the volumetric content of the elements of a composite material, one can produce materials with the required strength and magnetic, dielectric and special properties as a function of designation. The achieved properties in composite materials are significantly higher than those in alloys produced by ordinary methods. The reinforcing elements bear the main load in composite materials strengthened by continuous fibers or filament-like crystals, whereas the more plastic matric transfers stresses to the fibers. The strengthening fibers in manufacture of high-strength fibrous composite materials are arranged in the direction in which maximum strength must be achieved in the product. The ultimate strength of this composite material in the direction of continuous fibers [205] is $\sigma_k = \sigma_v V_v + \sigma_m^*(1 - V_v)$.

Among the undoubtedly promising composite materials of the light alloy type may be included high-strength fibers. Specifically, an aluminum-high-strength fiber composite material compared to aluminum alloys may provide high ultimate strength and specific strength, a high modulus of elasticity of reinforced aluminum alloys and also high heat resistance.

A number of Soviet and foreign monographs has been devoted to investigation of composite materials [17, 21, 29, 30, 71, 72, 73, 98, 121, 216, 219]. The topic of most of them is study of the effect of production parameters on the physicomechanical properties of composite materials. There are still insufficient papers in which the strength of composite materials, specifically the effect of temperature-time factors on their properties, are systematically investigated.

The monograph consists of eight chapters. Problems of the theory of composite materials are illuminated in Chapter 1. Chapter 2 is devoted to the technology of manufacturing composite materials. The existing methods of reinforcing metals are described and the methods used are outlined in detail. Chapter 3 is devoted to investigation of the properties of the reinforcing elements. Classification of the fibers is given and the physical and mechanical properties of tungsten wires, U8A, Kh18N10T and Kh13N13M2 steel wire and knitted netting based on them are investigated. The results of testing composite materials are outlined and the strength and plasticity, thermal expansion, electrical conductivity and other characteristics are investigated in Chapter 4.

One of the timely problems in investigating composite materials is the interaction of the components of the reinforcing systems at the fiber-matrix interface. Brittle layers of intermetallide phases which actively affect the strength of composite materials occur due to interaction and the interface. Chapters 5, 6 and 7 are devoted to study of these problems. The methods which reduce the tendency of reinforced systems to interaction are described in Chapter 8.

Contents

6521
CSO: 1870

PUBLICATIONS

COMPUTER ANALYSIS OF GEOPHYSICAL REGULARITIES

Moscow MATEMATICHESKOYE OBESPECHENIYE ISSLEDOVANIY GEOFIZICHESKIKH ZAKONOMERNOSTEY NA PRIMERE KOSMICHESKIKH LUCHEY, REZUL'TATY ISSLEDOVANIY PO MEZHDUNARODNYM GEOFIZICHESKIM PROYEKTAM (Computer Analysis of Geophysical Regularities by the Example of Cosmic Rays, Results of Research on International Geophysical Projects) in Russian 1978 signed to press 17 Apr 78 pp 5-7, 145, 152

[Annotation, foreward and table of contents from book by L. I. Dorman, I. A. Pimenov and V. V. Satsuk, Nauka, 1,100 copies, 153 pages]

[Text] The monograph describes the methods for computer-processing (analysis) of empirical time series. The problems of analysis of the quality of output information from geophysical instruments and the approximation of empirical data using elementary functions are discussed. Consideration is given to specific problems arising from studying the cosmic ray variations: inclusion of the atmospheric effect on cosmic ray intensity detected on the earth, the methods of analyzing the data of latitude expeditions. The method of digit filtration of the data, verification of their stationariness, calculations of selective spectra of power (in the Blackman-Tewkey version) are described. The problems of presentation of experimental data using the models of time series are considered. Main attention is paid to the problem of the practical application of one or another method. Data processing is a multistage complex and dynamic process. The available theoretical methods for mathematically analyzing the experimental data cannot be used directly by the experimenter in all cases, since even a ready method needs to be practically realized. The authors make an attempt to develop the methods for processing experimental data using techniques which may be computer realized in practice. The studied theoretical problems are programmed in each chapter and written in algorithmic language "Alpha" which is one of the specific representations of the International Algorithmic Language ALGOL-60. Application of the algorithms and programs is illustrated with a number of examples. Detailed instructions for using the Alpha-programs developed in the monograph are presented. Despite the fact that the set of algorithms is incomplete, the proposed set of programs permits the time series to be computer-analyzed within a sufficiently high effectiveness. The use of computers as a component element to reveal one or another regularity is a means to substantially speed up the process of application. All the proposed algorithms have been computer-approbated. The monograph is of interest for the researchers engaged in the analysis of empirical time series in cosmic ray physics and some fields of geophysics. It may be of especial help for experts when analyzing the long-term series of data obtained in the framework of the programs of international geophysical projects.

Contents

Preface

In this work an attempt has been made to generalize certain results of works by the authors on the information of studies on variations in cosmic rays. These results refer to the primary processing of data. Unfortunately, the term "primary processing" is insufficiently defined since the actual content of the primary processing of experimental data changes with time in any area of research. Variations in cosmic rays in this respect are not an exception.

The purpose of the book is to systematize and generalize certain known methods, as well as those proposed by the authors for computer analysis of empirical time series. A set of programs has been set up that makes it possible, in our opinion, to fairly completely solve the task of the primary analysis of data on variations in cosmic rays. The programs are written in the Alpha language--one of the specific representatives of the algorithmic language ALGOL-60--and, consequently, can be used on any computer where there are the appropriate translators.

We hope that the book will be useful also to representatives of other scientific trends since in addition to specific algorithms that can be applied in studies on the variations in cosmic rays, it has programs of more universal algorithms (spectral and mutual spectral analysis of time series, digital filtration, parametric models, etc.).

As is known, currently in the USSR the qualitative and quantitative growth in the fleet of electronic computers, as well as the rates for obtaining experimental information are continually increasing. At the same time a definite break is observed between the ever-increasing amount of experimental data and the potentialities of computer technology on the one hand, and the methods of rapid and comprehensive processing of data on the other hand. Any attempt to reduce this gap, apparently, is justified.

It has become standard to use electronic computers in geophysical studies. However the efficiency of their use, in our opinion, is still insufficient. The question of how to extract most completely, without distortions, and rapidly the necessary information from the data is, as before, an urgent one for the researcher who is involved in analyzing emperical time series. In examining the questions of the information content of the primary processing of data of ground observations from the variations in cosmic rays we attempted to preserve the possibility of using the programs cited in the book for other types of geophysical research. On the whole the book consists of six chapters constructed on a single principle: methods--programs--examples.

Chapter one describes the methods for quality control of the operation of cosmic ray stations, the set of stations and approximation of the observation results with the help of elementary functions. Quality control of the work of a separately taken station of cosmic rays is conducted with the help of a technique based on analysis of the output data of three channels of single-type physical information. Here the regular components are excluded and a joint analysis is made of fluctuations in the recordings of individual channels. The statistical characteristics of noise in the case of a malfunction in the operation of the channel are changed. The method makes it possible to find malfunctions in the running of individual channels, reveals the malfunction interval, and permits insertion of a correction into the data for the time of the malfunction. In that form that the method is stated here it can be used for quality control over the operation of any geophysical instrument that has three and more channels of single-type physical information. If the number of channels exceeds three the method is easily modified to find malfunctions in two and more channels. The Alpha-program that realizes this method is not given in the book since the questions of analyzing the data quality in setting up the network of cosnic ray stations is solved immediately as the stations are started, and with the help of that computer technology which is available at the sites. The method of quality control of the operation of the set of stations with the use of the single-factor model, in our opinion, can also be employed in any geophysical studies where the same phenomenon is recorded by the network of approximately the same instruments, for example in seismic measurements. The text of Alpha-programs is given that realizes this method, and examples of analysis of data on cosmic ray variations. The examples illustrate the need for a cautious approach to the use of the single factor model in analyzing the quality of data from the set of stations. Chapter one also examines the approximation of empirical relationships with the help of elementary functions. The Alpha-program of approximation makes it possible to make an approximation of data by any set made of 14 functions.

Chapter two covers specific questions: estimation of the effect of changes in atmospheric pressure on the intensity of the neutron component of cosmic rays. A practical calculation is given for the baronetric coefficient with the help of methods of paired and triple correlations, as well as the difference method. Algorithms are given for calculating the so-called partial baronetric coefficient that considers the variations in the primary stream, the rigidity of the cut-off and atmospheric pressure. An Alpha-program is given that realizes the the paired correlation method (in three modifications). Due to the limited nature of the book we have not examined the methods for improving the triple correlation technique that uses a single-factor model, as well as the direct use of this model for calculations of the barometric coefficient.

Chapter three examines the insertion of corrections for world variations of cosmic rays into the data for latitude expeditions, and calculates the coupling factors for the data of these expeditions. As is known, the correct computation of the coupling factors is very important for obtaining information on changes in the energy spectrum of the primary stream. The method for calculating the parameters of the coupling factors from experimental data of latitude expeditions proposed in chapter three is controversial since it proposes computing the coupling factors for rigidities that exceed the range in which the latitude measurements were made. In our opinion, the accuracy of the proposed method is determined by the correctness of the physical grounds taken in the a priori assigning of analytical expressions for the coupling coefficients. The Alpha-programs of chapter three make it possible to search for the optimal values of parameters and to calculate the coupling factors assigned in the two- and three-parametrical form. The methods presented in chapter three are illustrated in detail with examples of an analysis of data from latitude expeditions for the 19th cycle of solar activity.

Chapter four describes the methods of detecting the periodicities with the help of selective spectra of power. In the presentation we adhered to the current interpretation (in the Blackman-Tewkey version) of obtaining selective spectral assessments based on the use of the Fourier transform from the smoothed selective values for the autocorrelation function. The efficiency of the spectral approach depends to a considerable degree on the fulfillment of the conditions of stationariness, and as a consequence, on the preliminary digital [illegible] of experimental data. These questions are also examined in chapter four. The Alpha-programs given in chapter four make it possible to make the necessary computations in revealing the periodicities in recording the finite length. Here also examples are given for analyzing data on solar activity and fluctuation phenomena in cosmic rays.

Chapter five briefly presents a method for calculating the selective mutual spectra of power that permits a study of the amplitude and phase correlations of two statistically linked time series. The Alpha-program for calculating the correlation coefficients makes it possible to study this link in the time region. Two Alpha-programs for calculating the mutual spectra of power permit an analysis of the correlation links in the frequency function. "Preparation" of the correlation links in the frequency range provides additional information on their nature. It should be noted (this concerns the contents of chapter four to an equal degree) that the presence of programs realizing the methods of selective spectra is not a guarantee of success. Besides obtaining calculated spectra it is necessary to have the art of correct interpretation of the findings (this especially concerns the spectra of coherence and [illegible]).

Chapters four and five analyze the time series in the frequency fields; chapter six examines the analysis of these series directly in the time region with the help of parametric models. Due to the vigorous use of spectral methods the advances in analyzing the data with the help of time series models are much more modest and attract less attention of the researchers. However, the parametric models have known advantages: compactness of data recording, facility of physical interpretation for models of small orders, and the possibility of forecasting. Since the practical need for analyzing data on cosmic ray variations with the help of parametric models is currently not evident, the book does not examine the models with coefficients used in time, mixed models of the type "moving average-autoregression," models with predicting indicators, etc.

The book makes certain recommendations for the use and running of Alpha-programs.

The cited methods and their realization in the Alpha language, it goes without saying, cannot pretend to be complete even in the field of studying cosmic ray variations. However, we hope that to a certain degree they will help the researcher to save time and effort in analyzing experimental data.

9035
CSO: 1870

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000100020012-5

PUBLICATIONS

HYBRID COMPUTING DEVICES WITH SEPARATELY CONTROLLED PARAMETERS

Leningrad GIBRIDNYYE VYCHISLITEL'NYYE USTROYSTVA S DISKRETNOUPRAVLYAYEMYMI PARAMETRI in Russian 1977 signed to press 3 Nov 77 pp 2, 3-4, and 295-296

[Annotation, foreword, and table of contents of book by V. B. Smolov and Ye. A. Chernyavskiy, Izdatel'stvo "Mashinostroyeniye" 6,000 copies, 296 pages]

[Annotation]

[Text] The book considers aspects of the theory of hybrid computing equipment intended for the control of computer assemblies, mobile objects and various production processes. Also considered are the principles of the construction of hybrid computing devices based on computing elements with integral analog and digital characteristics. These devices provide for making all principal hybrid computing operations (addition, multiplication, division, integration and differentiation) in which the input and output values are expressed both in digital and analog form by use of physically different information carriers.

The book is intended for engineering and technical workers occupied with the problems of building specialized computer control devices.

Twelve tables, 182 illustrations, bibliography of 56 titles.

Foreword

One of the features of modern systems of the control of production processes and facilities is the diversified character of the presentation of information; that is, the combination of digital and analog forms with physically different signal carriers. This circumstance makes it difficult to use analog (AVU) or digital (TsVU) computing devices or machines (AVM, TsVM) directly in control systems.

Up to 1956 only analog computers were developed for control systems. Then beginning in 1956, with the emergence both in our own country and abroad of the digital computing devices, scientific investigations were carried out on the solution of the problems of the compatibility of the sensing and actuating members of the facilities to be controlled with digital computers. The converters of the forms of presented information which were developed as the result of these investigations successfully solved the problem posed within the limited framework of the forms of the presentations and the physical signal carriers.

The efforts of developers of control computing devices toward the use of the positive properties of analog and digital computers and also toward the direct execution of mathematical operations on dissimilar signals led to the creation of the hybrid (combination) devices of computing technology (GVT): a) hybrid computing complexes (GVK) based on the combination of analog and digital computing devices; b) hybrid computing devices (GVU) based on computer elements with integral analog and digital characteristics.

While hybrid computing complexes are being developed and used as the main form for the solution of problems connected with scientific investigations and the design of complex systems of control; hybrid computing devices are intended as the basis for the solution of problems of the direct control of the same facilities.

Among the trends in the development of hybrid computing devices are the so-called hybrid computing devices with separately controlled parameters (GVU-DP), the development of which began in 1957 in the faculty of computer technology of the LETI [Leningrad Electrical Engineering Institute] imeni V. I. Ulyanov (Lenin). The basis for the construction of GVU-DPs were electronic converters of the form of presentation of information.

Regarding the areas of application of GVU-DPs, it is advisable to use them in automating systems for the control of processes of production or production facilities in which the allowable error of computation is 1/2 percent, and the input and output information is presented by dissimilar physical carriers and codes, which makes the direct use of both analog and digital computing equipment difficult.

The importance of hybrid computing technology for modern control systems has been clearly set forth in what, at present, is the solitary foreign monograph by /D. Beki/ and /U. Karplyus/ entitled "The Theory and Application of Hybrid Computing Systems." However, in that book the aspects of the construction of hybrid computing systems are considered only on the basis of integrating analog and digital computing machines within the framework of the solution of one problem. By no means does that duplicate the contents of this particular monograph.

In view of the great volume of scientific and experimental data accumulated over 18 years, in selecting the organization of this work and determining its contents the problem was to reflect the most important and key aspects of the development of GVU-DPs; namely: a) to assess the distinguishing features of the construction and the possibilities of the use of GVU-DPs as an independent class of specialized computing equipment, b) to assess the results of the theoretical and experimental investigations, c) to develop techniques and recommendations for the design of GVU-DPs, and d) to define the paths of the future development of GVU-DPs.

All the materials presented in this work reflect the scientific and experimental investigations carried out, with the participation of the authors and under their leadership, by scientists in the scientific research laboratory of hybrid computing devices and systems of the faculty of computer technology of the LETI imeni V. I. Ulyanov (Lenin).

In writing the book much assistance was given the authors by T. I. Polyanskaya with whose assistance Chapters 2 and 7 were written; by B. A. Kurdikov in Chapter 6; by V. N. Pertsev and V. P. Karanchuk in Chapter 7; by D. D. Nedosekin in Chapter 9; by A. V. Kraynikov in Chapter 8; by V. V. Gorbaletov in part 1 of Chapter 4; and by V. D. Senin who wrote part 4 of Chapter 6.

The authors convey special thanks to Candidate of Technical Sciences T. I. Polyanskaya who took a most active part in all stages of the preparation of the book.

The authors will gratefully receive all comments and inquiries relative to matters touched on in the book.

Table of Contents

Contents (continued)

Contents (continued)

9136
CSO: 1870

PUBLICATIONS

PRINTERS FOR COMPUTING MACHINES

Moscow PECHATAYUSHCHIYE USTROYSTVA (Printers) in Russian 1977 signed to press 24 August 1977 pp 2 and 245-246

[Annotation and table of contents from book by N. N. Saveta, L. M. Khokhlov, B. C. Brikman, L. P. Dobretsov, V. I. Royzman, Izadatel'stvo "Mashinostroyeniye" 8000 copies 246 pages]

[Text] The methods and devices used in computing machines for the sequential or simultaneous printing of letter or digital information are reviewed. The compositions and principles of building printing devices are analyzed. Printers with both striking and nonstriking action are considered. Observations are made on the status and trends of the development of printers.

The book is intended for engineers and technical workers occupied with problems of the development of the means of recording letter and digital information.

7 Tables, 169 illustrations, bibliography of 47 titles.

CONTENTS

CONTENTS (continued)

9136
CSO: 1870

PUBLICATIONS

NUMERICAL METHODS IN THE MECHANICS OF CONTINUOUS MEDIA

Moscow VYCHISLITEL'NYYE METODY I PROGRAMMIROVANIYE (CHISLENNYYE METODY V MEKHANIKE SPLOSHNYKH SRED) XXVII--SBORNIK RABOT NAUCHNO-ISSLEDOVATEL'SKOGO VYCHISLITEL'NOGO TSENTRA MOSKOVSKOGO GOSUDARSTVENNOGO UNIVERSITETA (Computational Methods and Programming (Numerical Methods in the Mechanics of Continuous Media) XXVII--A Collection of Works from the Moscow State University Scientific Research Computer Center) in Russian 1977 signed to press 21 Feb 77 pp 2, 166

[Annotation and table of contents from book edited by V. M. Paskonov and G. S. Roslyakov, Izdatel'stvo Moskovskogo universiteta, 2600 copies, 166 pp]

[Text] The general direction of the collection is toward application of numerical methods in solving problems of aerohydromechanics and the theory of resilience. A number of preceding numbers of the series "Computational Methods and Programming" (numbers II, IV, VII, XI, XV, XIX, XXIII) have already been devoted to this topic. The collection consists of three sections. The first section contains articles on the application of the method of nets to calculating the viscous flow of a gas (flow in the wake behind a body, flow with consideration of the physical and chemical processes in the gas, etc.). The second section is devoted to numerical investigations of flow of non-viscous gas (the inverse method for calculating flow in nozzles, flow in nozzles with current fluctuation, flow of a gas in the presence of a magnetic field, problems of the relaxation of the vibrational degree of freedom). The third section is devoted to several theoretical questions of differential methods for solving problems of the theory of elasticity (isotropic and orthotropic plates).

The material in the collection will be useful to scientific and engineering and technical workers who are interested in numerical methods and their applications in the mechanics of continuous media, as well as to students and graduate students specializing in these areas.

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000100020012-5

Contents

8542
CSO: 1870

PUBLICATIONS

GEOPHYSICAL EXPLORATION EQUIPMENTS DESCRIBED

Leningrad GEOFIZICHESKAYA APPARATURA ("Geophysical Equipment") in Russian
Issue 62, 1977 signed to press 30 Jun 77 pp 157-158

[Table of contents from book edited by A. V. Matveyev, Izdatel'stvo Nedra, 2,200 copies, 160 pages]

[Text]

Contents

Page

Magnetometry

Nuclear Geophysics

Aero-Geophysical Methods

Maritime Geophysics

Mining Geophysics

Borehole Geophysics

9082
CSO: 1870

PUBLICATIONS

AUTOMATIC NAVIGATION OF HEAVY AIRCRAFT

Moscow AVTOMATIZIROVANNOYE VOZHDENIYE TYAZHELYKH CAMOLETOV in Russian 1973 signed to press 29 Jun 73 pp 2-4, 199

[Annotation, introduction and table of contents of book by V. N. Vasilinin, Voenizdat, 7,000 copies 199 pages]

[Annotation]

[Text] The book gives an account of the basis of automated navigation of heavy aircraft; that is, the aerial navigation and trajectory control of modern heavy aircraft. Their fundamental characteristics and classifications are cited. Much attention is given to the composition and functions of the crew. The principle of operation of flight navigation systems and their components is described. The algorithm and method of execution of typical, high-altitude, automated flight are verified. Flight preparations and post-flight analysis are briefly considered.

The book was written for pilots and navigators in military and civil aviation and also for a wider circle of aviation specialists interested in the automation of aircraft navigation.

Introduction

This book is dedicated to the automated navigation of modern heavy aircraft, the relative significance of which at public airfields, is continuously growing. Problems of navigation--the foundations of automated navigation--are presented in interrelationship with trajectory control.

Nowadays heavy aircraft are equipped with the most modern flight navigation systems. They ensure high accuracy and reliability in navigation, they simplify the work of the crew in flight, but they require a high level of training of flight personnel. This is because, though it is called automated, in the final analysis, navigation is carried out by the crew.

Despite the fact that flight navigation systems are widespread both in domestic and foreign heavy aircraft, the amount of literature about them is small and the basic attention in it is given only to principles of operation and the equipment in the individual systems and their technical characteristics.

The author set himself the goal of giving a general account of the principles of construction of flight navigation systems and the foundations of the procedures of navigation for the whole class of modern heavy aircraft. In almost equal degrees the book contains material of technical and methodological character.

A number of positions taken in the book are not as yet officially accepted and reflect only the author's opinion. For example, in the interests of generalization and systematization of the classifications of heavy aircraft and their flight navigation systems, as the starting point, two technical levels were assumed: modern and near future.

The majority of the formulas presented are intended to serve as reference material for the algorithms of on-board computers. To reduce the volume of the book, as a rule these formulas are presented without their derivations. Also on this reasoning, oft repeated lengthy terms are replaced by abbreviated designations.*

In writing the book, foreign and domestic periodical open literature was extensively used.

The author conveys deep gratitude to Professor, Doctor of Technical Sciences G. F. Molokanov and to Candidate of Technical Sciences E. P. Novodvorskiy for valuable counsel directed toward improving the contents and design of the book.

Table of Contents

*A list of accepted abbreviated designations is given at the end of the book.

Contents (continued)

9136
CSO: 1870

PUBLICATIONS

ABSTRACTS FROM THE PUBLICATION 'APPLIED GEOPHYSICS'

Moscow PRIKLADNAYA GEOFIZIKA No 91, 1978 pp 3, 15, 30, 47, 53, 64, 77, 87, 95, 101, 113, 131, 139, 145, 155, 162, 170, 178

UDC 550.834.5

THEORETICAL POTENTIALITIES FOR INVESTIGATING PINCH OUT ZONES THROUGH COMBINED PROCESSING OF COMPLEX REFLECTED WAVE SPECTRA

[Abstract of article by Polshkov, M. K.; Kondratovich, Yu. V.; Urupov, A. K.; and Bereza, V. G.]

[Text] As an example of processing experimental material obtained in the Shaimskiy Rayon of western Siberia, the theoretical potential is shown for the use of combined processing of complex spectra to recover an acoustical cross section of thin-layered member layers through transformation of both volume and structure. The precise position of the pinch out region for a productive sandy level, which holds promise for exploration, was determined.

4 illustrations and 3 bibliographical references.

UDC 550.834.05

SOME STUDIES OF WEIGHT STACKING IN CONVERTING TIME SECTIONS TO DEPTH SECTIONS

[Abstract of article by Tsyplakova, N. M.; Mushin, I. A.; and Kusidi, V. P.]

[Text] An algorithm for weighted stacking in converting time sections to depth sections with a preliminary stage of visual horizon tracking on a time section is reported. Test results of the algorithm on simulated materials are presented. Examined are the parameters which influence the efficiency of the conversion within the bounds of the proposed algorithm.

5 illustrations and 7 bibliographical references.

UDC 550.834.5

THE EVALUATION OF KINEMATIC AND DYNAMIC CHARACTERISTICS OF SEISMIC WAVES BY A STATISTICAL ANALYSIS OF A WAVE FIELD

[Abstract of article by Kondrat'yev, I. K., and Loginov, V. V.]

[Text] An evaluation of the kinematic and dynamic characteristics of reflected waves by a statistical analysis of a wave field (SAVP) was presented. In both experimental and actual materials it was shown that SAVP can successfully solve the task of determing the kinematic and dynamic characteristics of useful signals, wave interference and random noise. The utilization of these characteristics determined by SAVP in calculating OMF [optimal multichannel filters] systems allows for a qualitative improvement in the processing results of data by the CDP method.

7 illustrations and 8 bibliographical references.

UDC 550.834.5

SOME NEW CONSIDERATIONS OF REFLECTED WAVE TRAVEL TIME CURVES FOR FLAT-BEDDED MEDIA

[Abstract of article by Malovichko, A. A.]

[Text] A new formula is proposed for a travel time curve of a reflected wave for a layered medium. It is shown that the shape of the travel time curve is determined by three basic parameters -- bedding depth of the reflected border, the average dispersion velocity of the compressional oscillations and the value which characterizes the extent of the medium's heterogeneity. Distance limits were determined from point 0 to the reception point for which the formula is accurate.

1 table, 3 illustrations and 9 bibliographical references.

UDC 550.834.5.053:681.3

DIGITAL PROCESSING OF SEISMIC DATA BY THE CDP TECHNIQUE FOR NON-LINEAR REFLECTING SURFACES

[Abstract of article by Gur'yanov, V. M.; Karev, Ye. A.; and Pyatnitsina, M. V.]

[Text] Described is a new consideration for kinematic corrections of processing by the CDP technique for seismic exploration data which has been obtained in a layered heterogeneous medium and with non-linear separating surfaces between the layers. The kinematic corrections are calculated taking into account wave refraction on the surfaces. A new algorithm is proposed for inputting kinematic corrections which does not distort portions of the lines prior to summation. Calculation of the algorithm and correction inputs are accomplished on the BESM-4 computer and represent a sample test.

7 illustrations and 8 bibliographical references.

UDC 550.834.5

TWO-DIMENSIONAL TIME-VARIABLE ANALYSIS OF CDP SEISMOGRAMS

[Abstract of article by Meshbey, V. I., and Bogdanov, G. A.]

[Text] Examined is a two-dimensional time-variable analysis of a series of CDP seismograms [with travel time curves t(x) on CDP seismograms and travel time curves $t_o(x)$ on a time profile]. It was shown that the changeover to a two-dimensional transformation of the seismogram series substantially increases the accuracy in determining the kinematic parameters of reflected waves.

6 illustrations and 7 bibliographical references.

UDC 550.837.211

DISTORTIONS OF MAGNETO-TELLURIC SOUNDING CURVES ASSOCIATED WITH DIURNAL SURFACE DIP

[Abstract of article by Anishchenko, G. N.]

[Text] An evaluation is performed of distorted MTZ [magneto-telluric sounding] curves caused by the diurnal surface dip. Based on an approximation method for the solution a model of a homogeneous half-space with a surface dip, an atmospheric model with sloping plane-parallel layers and an atmospheric model with non-parallelism of the layers and diurnal surface were examined. The results of the calculations provide a concept of distortions for amplitudal and phased MTZ curves which are characteristic for such models.

2 illustrations and 5 bibliographical references.

UDC 550.837.211

COMPUTER PROCESSING OF MAGNETO-TELLURIC VARIATIONS IN THE RANGE OF 10 TO 1000 SECONDS

[Abstract of article by Bezruk, I. A.; Chernyavskiy, G. A.; and Chinareva, O. M.]

[Text] Presented is a generalization for testing mass processing of MTZ materials. A processing algorithm with selection of known impedance values is examined. It was shown that various processing programs which accomplish the algorithm provide for a high degree of accuracy in determining impedance; they are quite efficient and informative. Recommendations for improving the accuracy and determining impedance in the future are formulated.

3 illustrations.

UDC 550.837.82

DETAILING AND DEPTH OF THE TRANSIENT METHOD IN MAGNETIC MODIFICATION IN THE CASE OF A CONDUCTING HEMISPHERE

[Abstract of article by Gubatenko, V. P.]

[Text] Based on the investigation of the influence of various areas of a conducting hemisphere on the total electrical field, a comparative analysis of detail, depth and sensitivity to flat heterogeneities of the method for establishing the electromagnetic field in near and distant zones is provided. It is shown that the detail of the field build-up soundings are better in the closer zone than in the far one.

2 illustrations and 9 bibliographical references.

UDC 550.837.211

A MAGNETO-TELLURIC FIELD OVER GENTLY SLOPING ELONGATED STRUCTRUES

[Abstract of article by Pecharich, Ye. I.]

[Text] Examined is the problem concerning magneto-telluric sounding on the surface of a multi-layered medium with wavy foundation surfaces along the length of the electromagnetic waves in layers of considerably greater amplitudal irregularity. A solution was derived with the assistance of the method for removing the boundary conditions on the surface.

1 illustration and 7 bibliographical references.

UDC 550.831

A REALLY ACHIEVABLE ACCURACY FOR ESTIMATING INTEGRAL CHARACTERISTICS OF IRON ORE DEPOSITS FROM GRAVITY AND MAGNETIC ANOMALIES

[Abstract of article by Strakhov, V. N., and Shaposhnikova, N. Yu.]

[Text] Described are the results of investigating integral and approximated three-dimensional techniques for determining the integral characteristics of perturbing substances in complex simulated examples. The advantages of the approximated techniques were shown. An evaluation of a really achievable accuracy in determing the integral characteristics of magnetic iron ore deposits is given.

5 tables, 3 illustrations and 15 bibliographical references.

UDC 550.831.016

THE RESULTS OF STATISTICAL PROCESSING OF REGIONAL GRAVITY AND PSEUDOMAGNETIC ANOMALIES

[Abstract of article by Portnova, V. P.]

[Text] The results of the statistical processing of the Δg for the territory of the USSR are presented. As a result of a two-stage differentiation of a normalized autocorrelation function $\rho(\tau)$ of an anomalous gravitational field, pseudomagnetic correlation functions are derived. A comparison of the parameters $r_{0\ pm}$ and $T_{0\ pm}$ with similar parameters derived through an anomalous magnetic field shows a certain discrepancy in these parameters.

1 table, 6 illustrations a 9 bibliographical references.

UDC 550.831.01

SOME ASPECTS OF OBSERVED GRAVITY FIELD REDUCING

[Abstract of article by Mikhaylov, I. N.]

[Text] The physical nature of reducing the observed gravitational field is examined. A comparison of various types of anomalies (in the open atmosphere, Bouguer's, (Prey's) and their analogies) with the objective of selecting the most effective for geologic interpretation of the data from gravimetric mapping is presented. It is shown that in any situation the validity of dynamic reducing and (Prey's) analog reducing is higher than Bouguer's reducing.

12 bibliographical references.

UDC 550.831.01

THE POSSIBILITY OF USING GRAVITY LOGGING DATA IN REDUCING GROUND GRAVITY ANOMALIES

[Abstract of article by Prishivalko, A. I.]

[Text] It is shown theoretically that Bouguer's reducing with variable values of apparent density which is determined by gravimetric techniques does not allow for the exclusion of distortions which are connected to the dense heterogeneity of the intermediate layer and the variable distance of the observation points from the disturbing masses, that is it does not conform to the true values of the gravitational anomalies at the reference level.

1 table, 2 illustrations and 6 bibliographical references.

UDC 550.832.05:681.3

AN OPERATIVE INTERPRETATION OF BOREHOLE GEOPHYSICAL MEASUREMENTS IN LOGGING COMPUTING MINICENTERS

[Abstract of article by Gruzinov, V. A.; Sokhranov, N. N.; and Strukov, A. S.]

[Text] Shown is the merit for applying logging computing minicenters for the processing and interpretation of geophysical data from borehole measurements. The problems which are resolved through logging minicenters are examined and the technological systems and processing results are presented.

4 illustrations.

UDC 550.832.46

DATA INTERPRETATION OF A WAVE SONIC LOG

[Abstract of article by Shcherbakova, T. V.; Fokina, I. L.; and Ivanov, N. N.]

[Text] Presented are the results of investigating a complete sonic signal which has been obtained in a borehole from a wideband sonic logging apparatus. Given is the analysis of various wave types in a sonic logging wave pattern which compares the results of manual and machine processing for wave patterns. Shown is the geologic information content of separate wave parameters and the method for isolating the collectors with secondary porosity is presented. The results of the test of this method are presented.

3 illustrations and 4 bibliographical references.

UDC 550.832.05:681.3

HIGH-SPEED PROCESSING OF OIL FIELD GEOPHYSICAL DATA

[Abstract of article by Zinchenko, A. I.]

[Text] Questions concerning the processing and interpretation of geophysical data from borehole measurements (GIS) with the aid of specialized computation which has been installed in a logging station are covered. The tasks which have been resolved are examined and the results of the GIS data processing in borehole logging are presented.

4 illustrations and 4 bibliographical references.

UDC 550.832.542

A QUANTITATIVE STUDY OF PULSE NEUTRON LOGGING INFORMATION CONTENT

[Abstract of article by Polyachenko, A. L., and Tseytlin, V. G.]

[Text] A quantitative approach to the evaluation of the information content of the INNK [pulse neutron-neutron logging] and INGK [pulse neutron-gamma logging] methods is developed. An algorithm is developed in the DEL'TA program for the BESM-4. Raw data serve as the INK [pulsed neutron logging] readings which were calculated on the RUM-3 program in a given network of spatial terminals for the parameters of the logging task. The boundaries of the INK efficiency regions were found and the accuracy for determining the stratum parameters relative to its porosity, mineralization of its water deposit, the diameter and stopping of the borehole and the measurement mode were evaluated. Given is a comparative analysis of the effectiveness of INNK and INGK, as well as the measurement methods for the particle flows and attenuating decrements. The connection of information content with the distribution of particles was examined; and in particular the impossibility for complete homogenization of the compressed borehole in INNK is shown.

3 table, 4 illustrations and 6 bibliographical references.

9082
CSO: 1870

END